PROBLEMS.

346. *By Prof W. W. Hendrickson.*—Chords of the parabola $y = 4ax$ are drawn through the fixed point (h, k); required the locus of the intersection of normals drawn at the extremities of the chord.

347. *By Prof. A. Hall.*—Given $z = a \sin(x+\alpha) + b \sin(y+\beta)$, reduce z to the form

$$z = D \sin \tfrac{1}{2}(x+\alpha+y+\beta+\delta).$$

348. *By R. S. Woodward, Detroit, Mich.*—Show how to determine the values of x and z which will render

$$\begin{aligned} u = {} & +2a_1\cos(\ qz+\tfrac{1}{2}qx+\beta_1)\sin\tfrac{1}{2}qx \\ & +2a_2\cos(2qz+\ qx+\beta_2)\sin\ qx \\ & +2a_3\cos(3qz+\tfrac{3}{2}qx+\beta_3)\sin\tfrac{3}{2}qx \\ & +\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ .\ \ . \\ & +2a_n\cos(nqz+\tfrac{n}{2}qx+\beta_n)\sin\tfrac{n}{2}qx, \end{aligned}$$

a max. or min., a_1, a_2, etc., β_1, β_2, etc. and q being constants.

349. *By Prof. W. W. Johnson.*—From any point B of a circle, whose radius is a, a perpendicular BR is drawn to a fixed straight line whose distance from the centre is b; and from R a perpendicular RD is drawn to the tangent at B. Produce RD to P making $DP = RD$. Find the rectangular equation of the locus of P, and of the evolute of this locus.

[This is a re-statement of 321, as the solution of that problem by Prof. Casey indicates that it was not understood as Prof. Johnson intended.]

350. *By Request.*—A series of circles touching each other at a point are cut by a fixed circle; show (by third Book of Euclid) that the intersections of the pairs of tangents to the latter, at the points where it is cut by each of the other circles, lie in a straight line.

351. *By Marcus Baker, U. S. Coast Surv., Washington, D. C.*—In a plane triangle ABC, a line from C perpendicular to AC meets AB in M, and another from C perpendicular to BC meets AB in N; knowing the sides a and b and the intercept $MN = m$, it is required to determine the triangle.

352. *By Artemas Martin, M. A., Erie, Pa.*—Two chords of equal but unknown lengths are drawn at random in a given circle; find the chance of their intersection.

353. *By William Hoover, Wapakoneta, Ohio.*—Required the average area of the circles described on the focal chords of a given ellipse as diameters.

353. *By Prof. H. T. Eddy, Cincinnati, Ohio.*—A cube slides down an inclined plane with four of its edges horizontal. The middle point of its lowest edge comes in contact with a small fixed obstacle and is reduced to rest. Find the direction of the impulsive reaction of the obstacle, and show that it is independent of the velocity of the cube and of the inclination of the plane. Determine also the limiting velocity that the cube may be on the point of overturning.

QUERY BY PROF. A. HALL.—"Observations on the motions of the sun-spots have also established the fact that the sun is not strictly a fixed body, around which the earth revolves, but that it has a motion of its own thro' space." *Physiography*, by T. H. Huxly, F. R. S., 2nd Ed., p. 365.

How can the above fact be determined by observations of the sun-spots ?

QUERY BY PROF. W. W. JOHNSON.—Let $u = \frac{\sin ax}{a}$.

Now if $a = \infty$, $u = 0$ independently of the value of x, therefore we should have $\frac{du}{dx} = 0$ when $a = \infty$ But we find $\frac{du}{dx} = \cos ax$ which is essentially indeterminate when $a = \infty$. What is the explanation of this paradox ?

NOTE BY WILLIAM HOOVER.—In Todhunter's *Plane Trigonometry*, p. 142, Third Edition, 1864, we have the following problem:

Eliminate θ from the equations

$$(a+b)\tan(\theta-\varphi) = (a-b)\tan(\theta+\varphi),$$
$$\cos 2\varphi + b\cos\theta = c.$$

The coefficient of the first term of the left member of the second equation is omitted. The cofficient of $\cos 2\varphi$ is a.

This erratum is pointed out as Todhunter's mathematical works are remarkably free from typographical errors.

PUBLICATIONS RECEIVED.

Meteorological Researches by WILLIAM FERREL. Part II. On Cyclones, Tornadoes and Water-spouts. Appendix No. 10—Report for 1878 of the Superintendent of the United States Coast and Geodetic Survey. Quarto. 95 pages and six plates. 1880.

American Journal of Mathematics, Vol. III, No. 3.

The papers in this No. are, A Method of Developing the Perturbative Function, by Simon Newcomb; On De Morgan's Extension of the Algebraic Processes, by Miss Christine Ladd; On the Motion of a Perfect Incompressible Fluid when no Solid Bodies are Present, by Henry A Rowland; and, On certain Possible Cases of Steady Motion in a Viscous Fluid, by Thomas Craig.